CNC-UNI Service Model

IEC/IEEE 60802

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Relevant Contributions

- cc-ademaj-YANG-models-for-CNC-0117-v01

- 60802-Steindl-Configuration-0718-v02

- 60802-Steindl-ConfigurationModelAlignment-0718-v01

- 60802-woods-QccUNI-0718-v01

- 60802-woods-QccConfig-0918-v01

- new-kehrer-TSN-Configuration-Enhancements-0319-v01

- dj-kehrer-P8021Qdj-d0-0-update-0520-v01

- dj-kehrer-P8021Qdj-d0-0-update-0520-v01

- dj-ademaj-cnc-cuc-roles-0121-v01

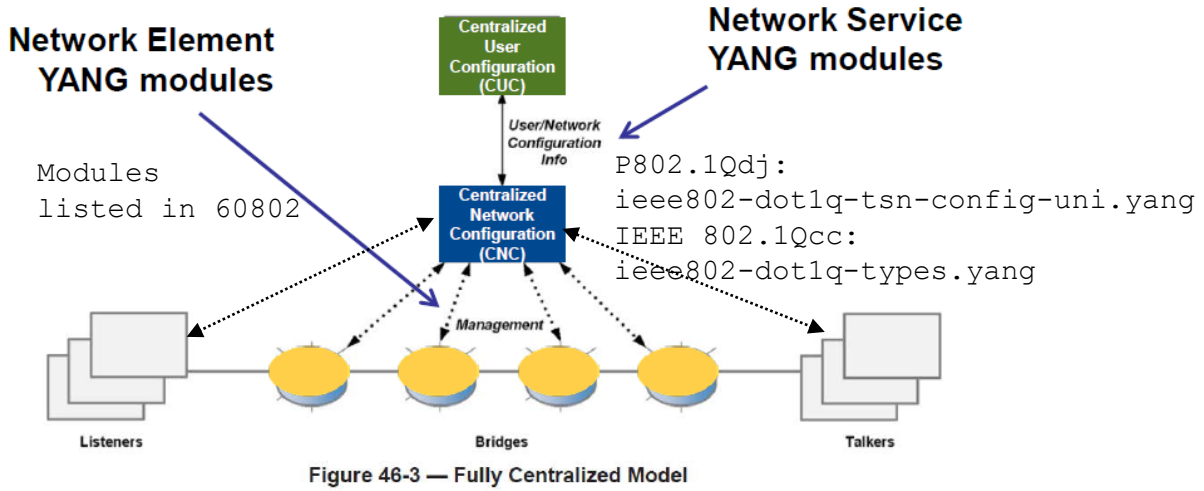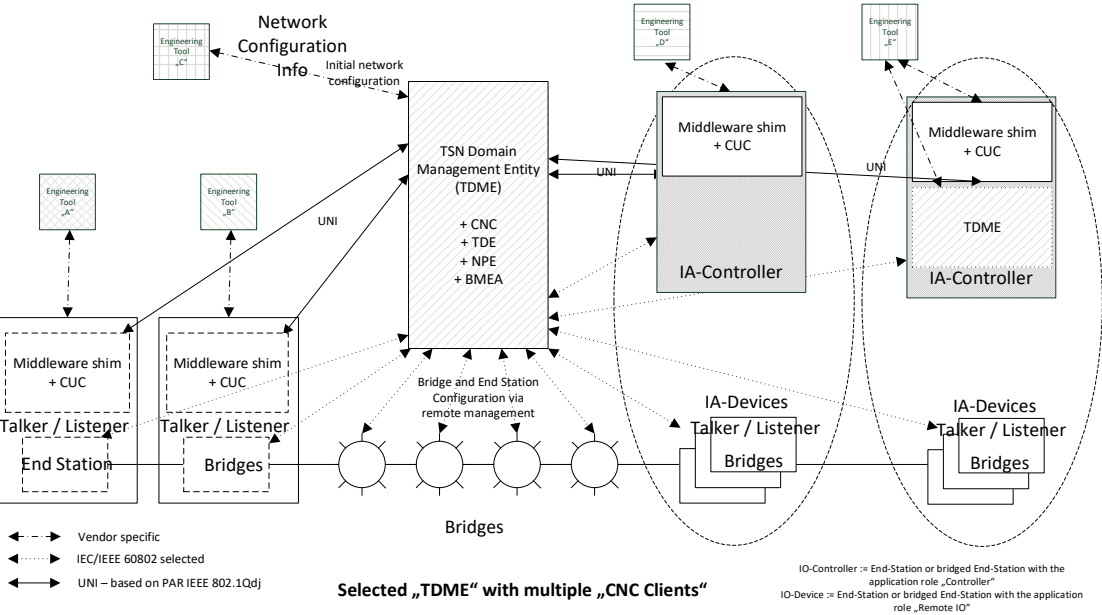- dj-Coelho-CNC-Requirements-0721-v03

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Overview

Motivation:

Advancements in development of IEC/IEEE 60802 provide us a deeper insight in the indented use cases and the system architecture of TSN in industrial automation than it was the case when IEEE802.1Qcc and P802.1Qdj have begun their lifecycle. The motivation of this contribution is to provide a comparison between the possibilities that IEEE802.Qcc and P802.Qdj offer and the uses cases that IEC/IEEE 60802 aims to cover, to come to a common understanding of the possible gaps and to provide suggestions for the closure of the gaps, if they exist.

Contents:

- IEC/IEEE 60802 Network Configuration Recap
- CUC Responsibilities
- CNC Responsibilities
- CNC Compliance
- UNI Service Data Model
- Concerns

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60802 Network Configuration Recap

Selected „TDME" with multiple „CNC Clients"

IO-Controller := End-Station or bridged End-Station with the application role „Controller"
IO-Device := End-Station or bridged End-Station with the application role „Remote IO"

Figure 46-3 — Fully Centralized Model

Network Element YANG modules

Modules listed in 60802

Network Service YANG modules

P802.1Qdj:
ieee802-dot1q-tsn-config-uni.yang
IEEE 802.1Qcc:
ieee802-dot1q-types.yang

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Centralized User Configuration (CUC) - P802.1Qdj:

- There are no conformance requirements for the CUC specified in IEEE 802.1Qcc and P802.1Qdj

- It is a logical entity that can be located in any device of a network (e.g. a bridge, end-station, engineering tool, or network management system), which
  - Collects application level QoS requirements (e.g. application cycle time) for TSN Streams from Talkers and Listeners
  - Translates the stream requirements from Talkers and Listeners to merged stream requirements
  - Communicates the merged stream requirements to the CNC
  - Retrieves the merged end-station communication-configuration from the CNC
  - Distributes the end-station communication-configuration to Talkers and Listeners

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Suggested text (P802.1Qdj 46.1.5)

- One or more logical entities that can be located in any station of a network (e.g. a bridge, end-station, engineering tool, or network management system), which

  - Collect application level QoS requirements (e.g. application cycle time) for TSN Streams for its Talkers and Listeners
  - Translate the stream requirements from its Talkers and Listeners to stream requirements
  - Communicate the stream requirements over UNI
  - Retrieves the talkers and listeners communication-configuration over UNI
  - Distributes the communication-configuration to Talkers and Listeners

- CUC is only an abstract concept and can be invisible or missing from the customers point of view

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# Centralized Network Configuration (CNC) - P802.1Qdj:

- A logical entity that configures network resources on behalf of TSN applications (users) and can be located in any device of a network (e.g. a bridge, end-station, engineering tool, or network management system), which
  - Receives the merged stream requirements for a TSN Stream from the CUC
  - Computes paths for requested streams
  - Performs computation of scheduling and/or shaping configuration for the requested streams
  - Configures the network devices to provide the required services and resources for the streams (e.g. FDB entries, configuration of transmission gates, …)
  - Provides the merged end-station communication-configuration for the streams to the CUC.

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Suggested text (P802.1Qdj 46.1.6)

- A logical entity that configures network resources on behalf of applications (users) and can be located in any station of a network(e.g. a bridge, end-station, engineering tool, or network management system), which

  - Is responsible for a single TSN domain

  - Configures the stations of a network to provide the required services and resources for the streams (e.g. FDB entries, configuration of transmission gates, …)

  - Supports connections to multiple clients over UNI including secured access

  - Receives the stream requirements for a requested Stream over UNI

  - Support additions and removals of streams

  - Computes paths for requested streams

  - Performs computation of scheduling based on the station configuration for the requested streams

  - Provides the talkers and listeners communication-configuration for the streams over UNI

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CNC Compliance IEEE 802.1Qcc, P802.1Qdj

- Support the use of a remote management protocol
- Support the managed object definitions and encodings for Stream reservation remote management
- Support the use of at least one protocol for User / network configuration information that complies with the requirements for protocol integration defined in 46.2.

- Suggestion – add support of:
  - Resource allocation
  - Sync tree
  - Path computation
  - Network and interface discovery
  - Network provisioning
  - Exposure of its capabilities (number of stations, number of streams…)

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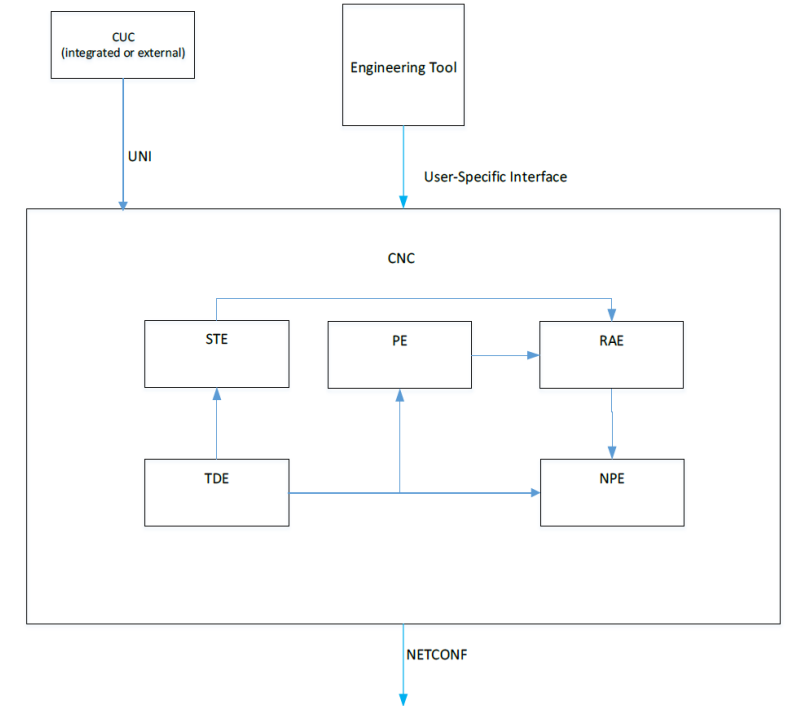
UNI Protocol Integration Requirements

- Defined in IEEE 802.1Qcc, subclause 46.2:
  - TSN configuration is a request/response exchange:
    - Request: CUC transmits a protocol message that contains a Talker or Listener group.
    - Response: CNC transmits a protocol message that contains a Status group

  - For each Talker group and Listener group, there are two operations for each Stream:
    - Join: Talker/Listener request to join the Stream and to configure network resources for this Stream's data transfer.
    - Leave: Talker/Listener request to leave the Stream and to release the network resources for this Stream

- Defined in P60802 (accepted comment of the latest draft):
  - Support of NETCONF over TLS is mandatory for UNI

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UNI Service Data Model P802.1Qdj: (1/2)

- The CNC communicates with the CUC through the Configuration-UNI defined in IEEE 802.1Qdj

- Compliance requirements:

  - draft: ieee802-dot1q-tsn-config-uni.yang (P802.1Qdj)

    - Stream list – key is streamID

    - Each Stream consists of a stream ID(rw), a request container (rw), and a configuration container(ro)

    - CUC -> stream ID, request container

    - CNC -> configuration container

      - Presence container -> its presence indicates that there is a configuration for a given request

    - No RPCs

      - It is up to CNC to check the request container and proceed with stream (re)configuration

      - It is up to CUC to check the status of the request stream

      - Is this in line with the IEEE802.1Qcc description of the TSN configuration as a request/response exchange?

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UNI Service Data Model P802.1Qdj: (2/2)

- Status of the requested stream is provided in the configuration container
  - The groupings are taken over from ieee802-dot1q-tsn-types.yang (IEEE 802.1Qcc)

  - Group-status-stream
    - Talker status (not detected, ready, failed)
    - Listener status (not detected, ready, partial-failed, failed)
    - Failure code
    - List of failed interfaces

  - Group-status-talker-listener
    - Accumulated latency (worst-case maximum)
    - Interface configuration (MAC Add., VLAN Tag, IP tuples, time aware offset)

  - Information about the dynamics is not available (e.g. waiting time, blocking or not…)

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Concerns

- IA Use Case (Plug and Produce):
  - Up to 2000 streams
  - Highly dynamic establishment of streams
  - High number of UNI clients
  - UNI clients based access control model

- Issues:
  - A UNI client locks the Candidate DS, one or more other clients want to request a stream
  - How can we prevent a UNI client to access the data of a particular stream?
  - CNC has to poll the request container constantly for changes (join / leave etc.)
  - Stream IDs are generated by clients (MAC Address + 16 bit), but the physical device can be changed with the whole configuration being copied. This replacement should be possible without network reconfiguration.
  - Information about the dynamics is missing (e.g. waiting time)?

- Proposal:
  - RPCs, access control, CNC manages the stream IDs etc.

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Conclusion

- draft: ieee802-dot1q-tsn-config-uni.yang (P802.1Qdj) currently does not fulfill the new 60802 use cases

- The UNI service interface model needs specified requirements for:
  - Number of supported clients
  - Number of supported streams
  - Time-out definition for stream establishment

  …

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Thank You!
Questions?

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